Safe and Secure Integration of Automation Systems and Enterprise IT Infrastructure Using Cloud

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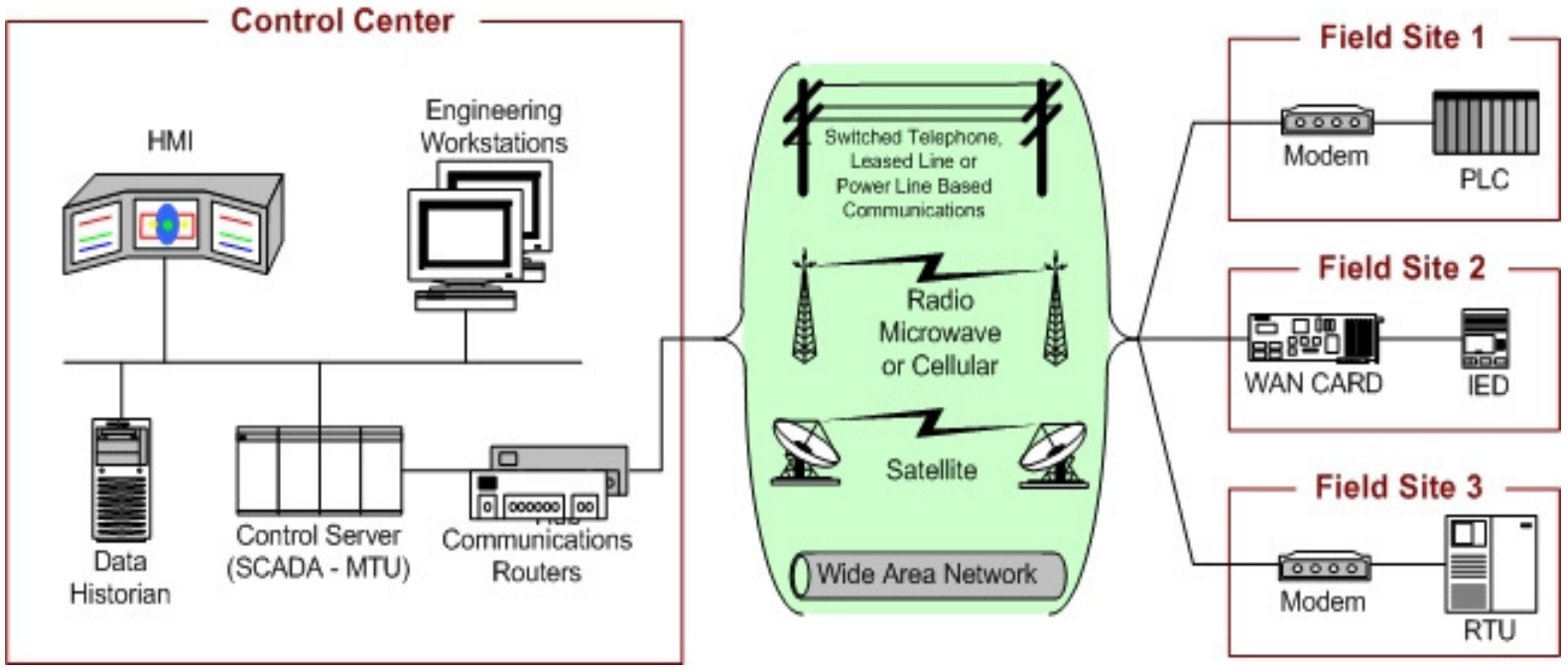
Instead of a Talk Outline

Essentially about 2 things:

- Integration of Automation & Enterprise IT in the Cloud
- How do Safety and Security play in it?

Typical Automation System (SCADA) Architecture



Source: NIST SP 800-82, June 2011

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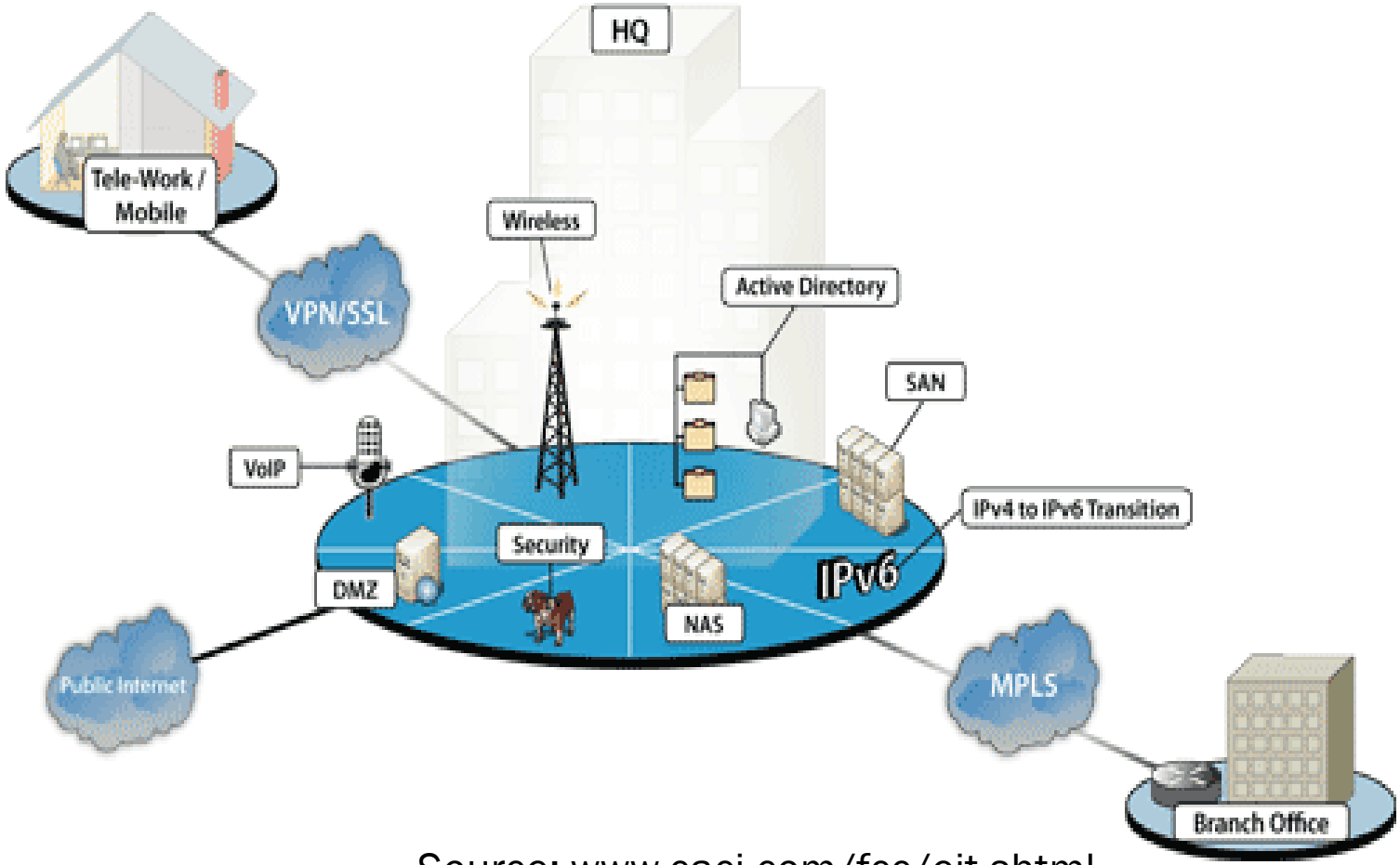
Typical Enterprise IT Architecture



Source: www.caci.com/fcc/eit.shtml

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Problems with Separate SCADA and IT Infrastructure

- IT system maintained by corporate IT
- Typically CS/CIS/IT/MIS graduates
- SCADA system maintained by process control engineers
- Typically EE/ME/ChE graduates
- Two separate maintenance hierarchies
- SCADA engineers not very familiar with IT problems and vice versa

Similarities Between SCADA and IT Systems

- Both are monitored 24x7x365
- Both have availability, reliability, safety, and security requirements
- Both have distributed nature
- Both have centralized hubs: servers in the case of IT and master terminal unit in the case of SCADA
- and …

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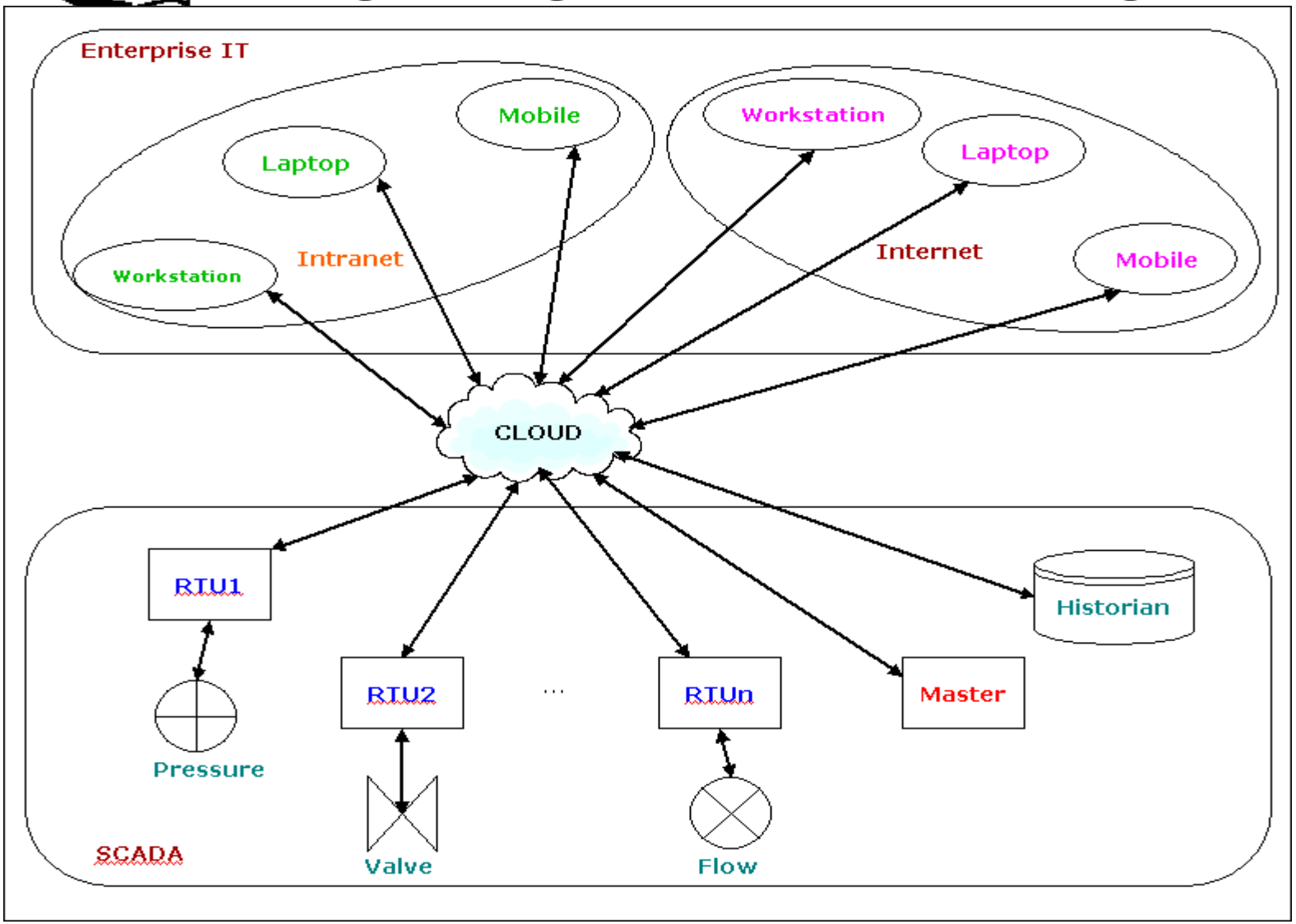
- Both have centralized hubs: servers in the case of IT and master terminal unit in the case of SCADA
- Both can be integrated to run in the cloud

Integrating IT &SCADA using Cloud



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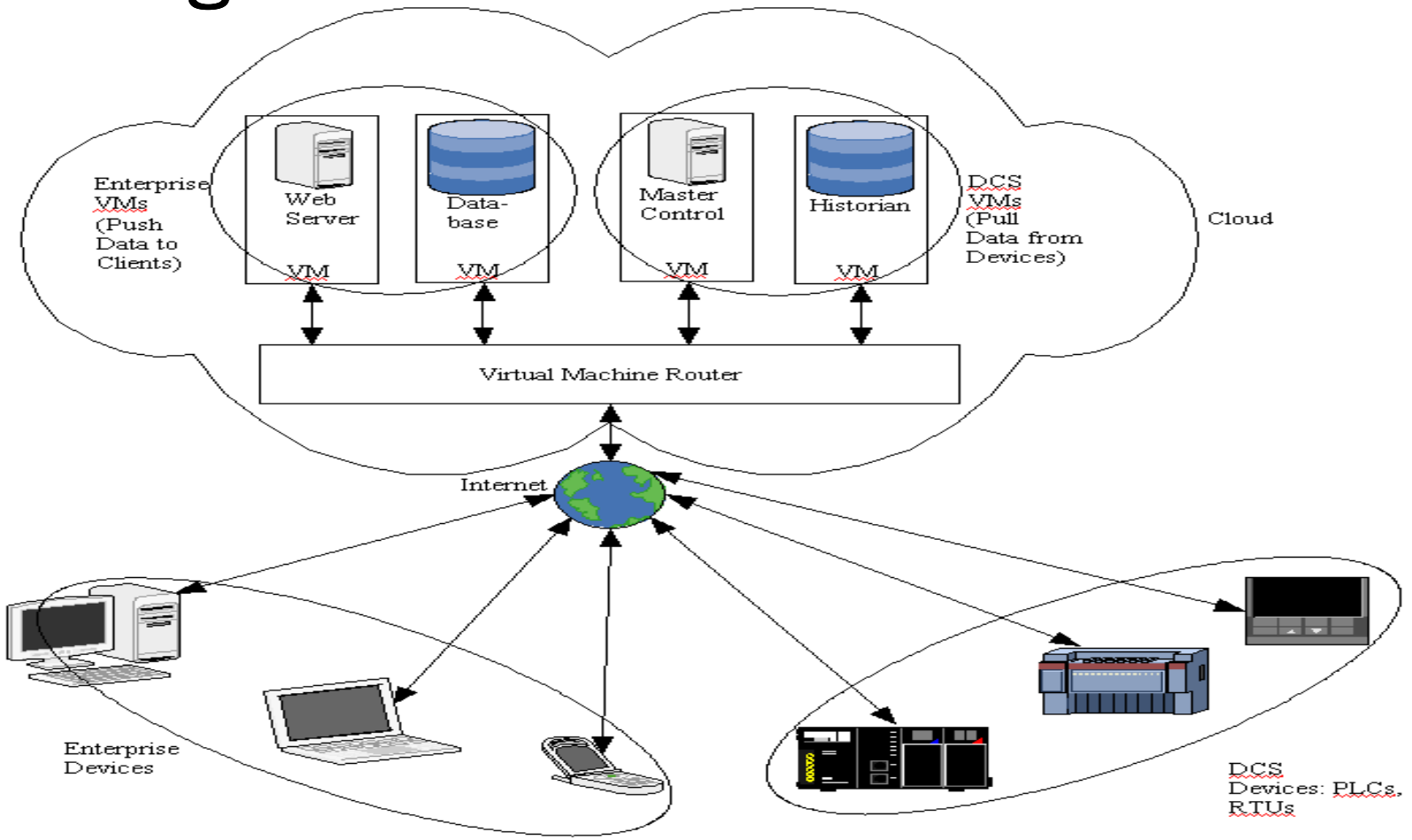
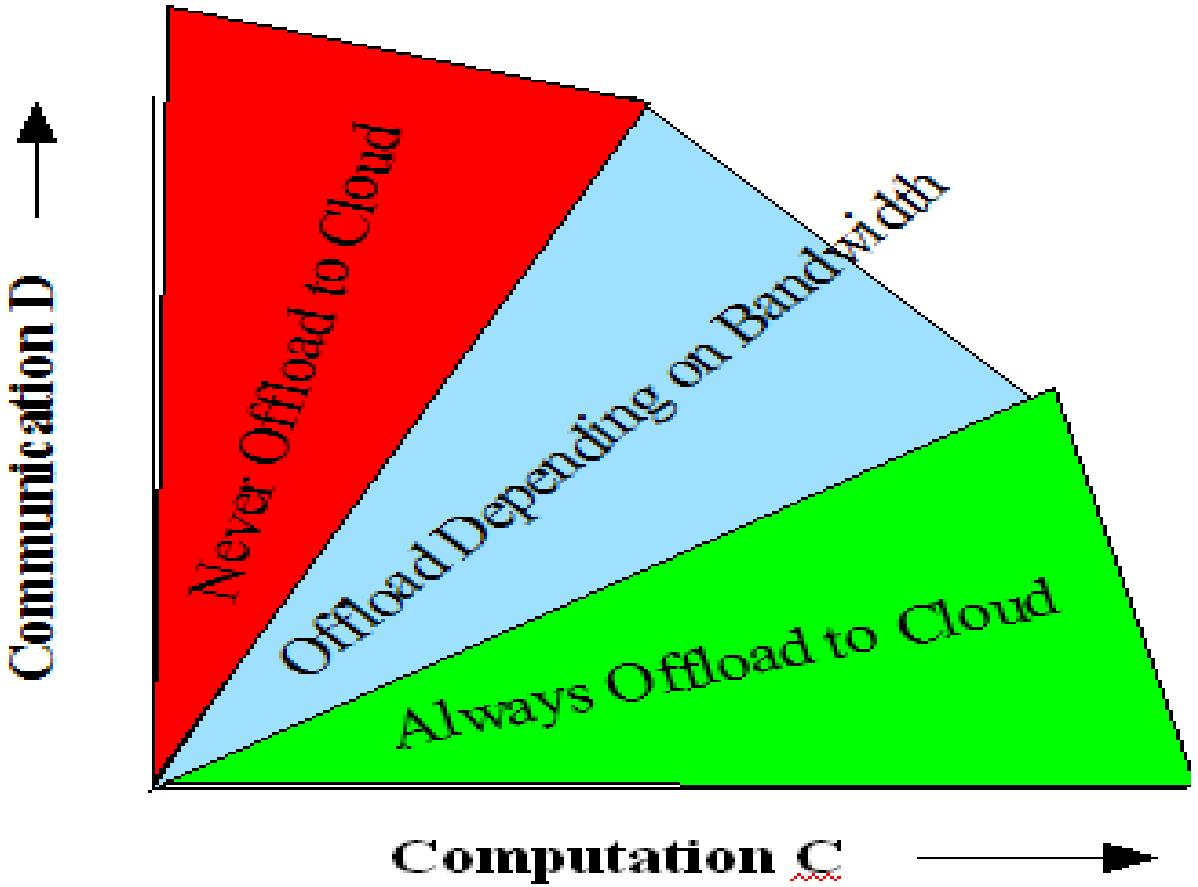
Integrated Cloud-based Infrastructure



Integrated Architecture Advantages

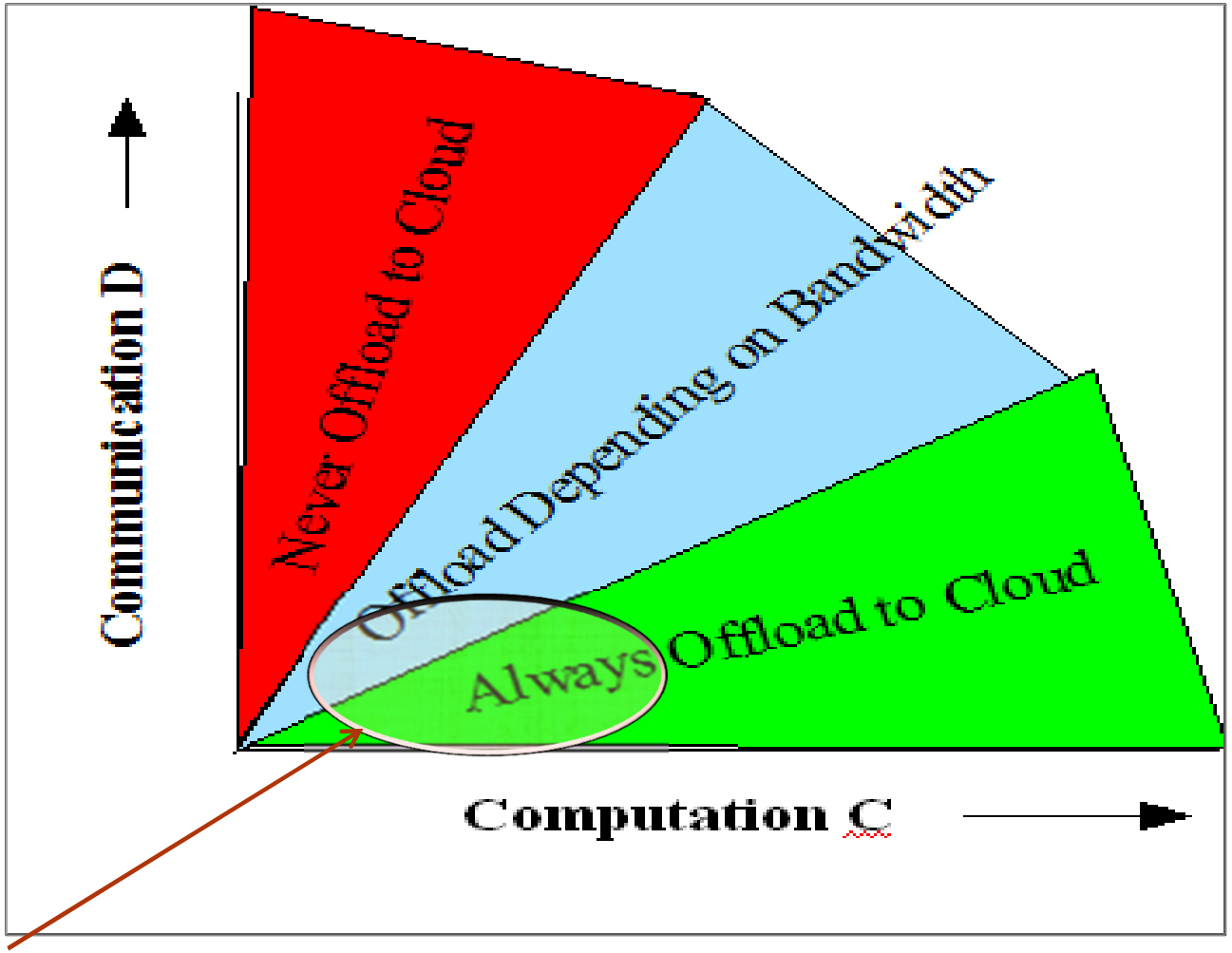
- All operations handled through cloud service provider
- SCADA components and IT components integrated through the cloud
- IT components need middleware (running in cloud data center) to link them to the correct servers
- SCADA components need middleware (running in cloud data center) to link them to the correct master and historian
- Security becomes more affordable for the organization for both IT and SCADA infrastructure
- IT and SCADA can be interlinked in the cloud improving security of inter-system access
- Provides for better management of both IT and SCADA systems

When do you use Cloud?



Source: "Cloud Computing for Mobile Users: Can Offloading Computation Save Energy", K. Kumar and Y-H Lu, IEEE Computer, April 2010, pp. 51 – 56.

Where is SCADA?



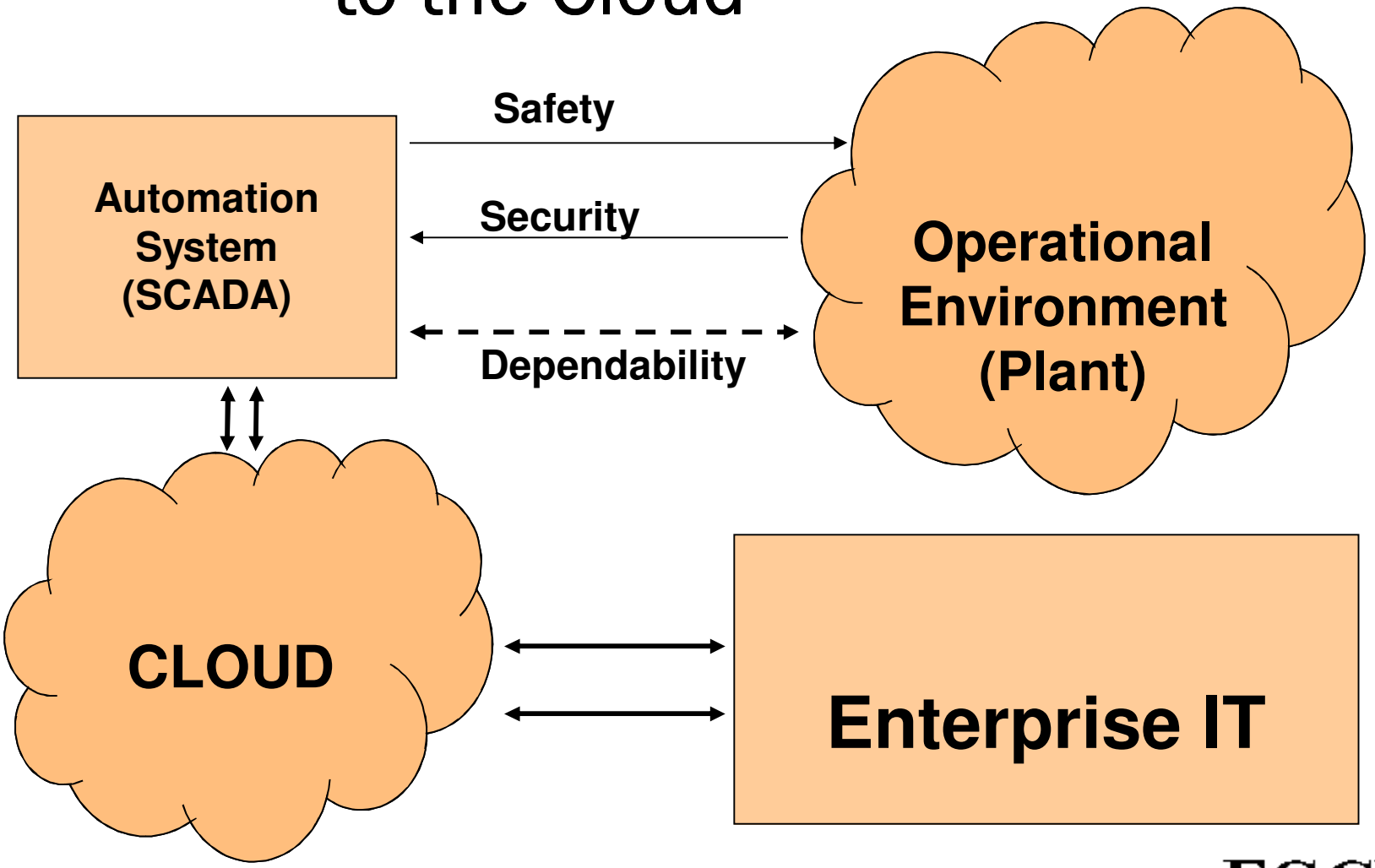
SCADA is in this region

Critical System Properties:

- Safety
- Security
- Reliability
- Availability
- others

Can they be transferred to the Cloud?

Transferring Safety and Security to the Cloud



Safety vs. Security: General View

- Safety is concerned when a technical or social system negatively affects the environment

  Latest example: Fukushima Nuclear Power Plant
- Security …

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- Security is concerned when an Environment negatively affects the technical or social system

  Latest example: wiki leaks release of classified information
- In both cases, the system must continue functioning
- In both cases, safety and security affect each other

Safety vs. Security: General View

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  This means that there are generally not measurable, since there are no computable functions that would map respective properties onto a number set
- Thus …

Safety vs. Security: General View

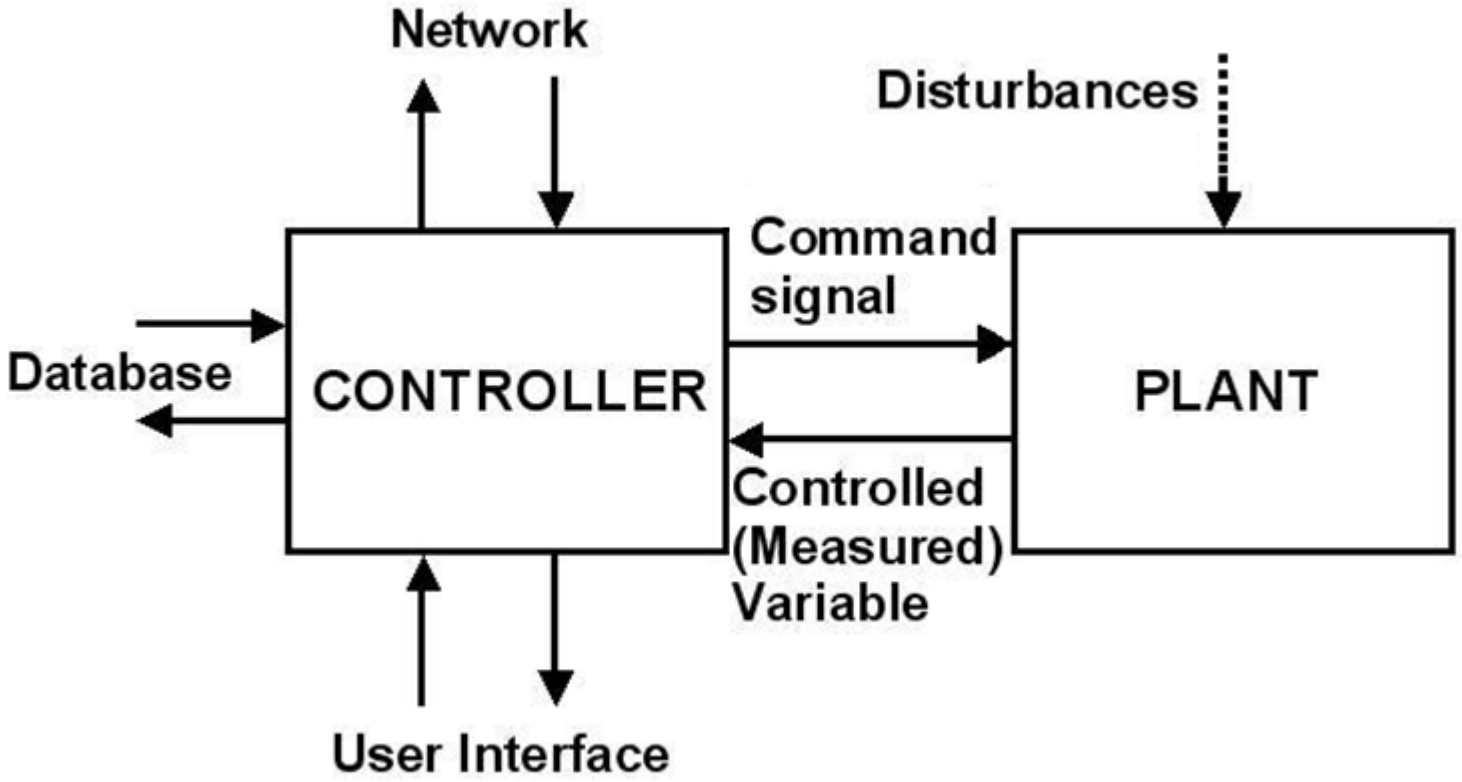
- Safety and Security are negative properties

  This means that there are generally not measurable, since there are no computable functions that would map respective properties onto a number set
- The only practical way to evaluate Safety and Security is modeling:

  - modeling hazards for Safety assessment, and

  - modeling threats for Security assessment.

Example of a Modeling Architecture



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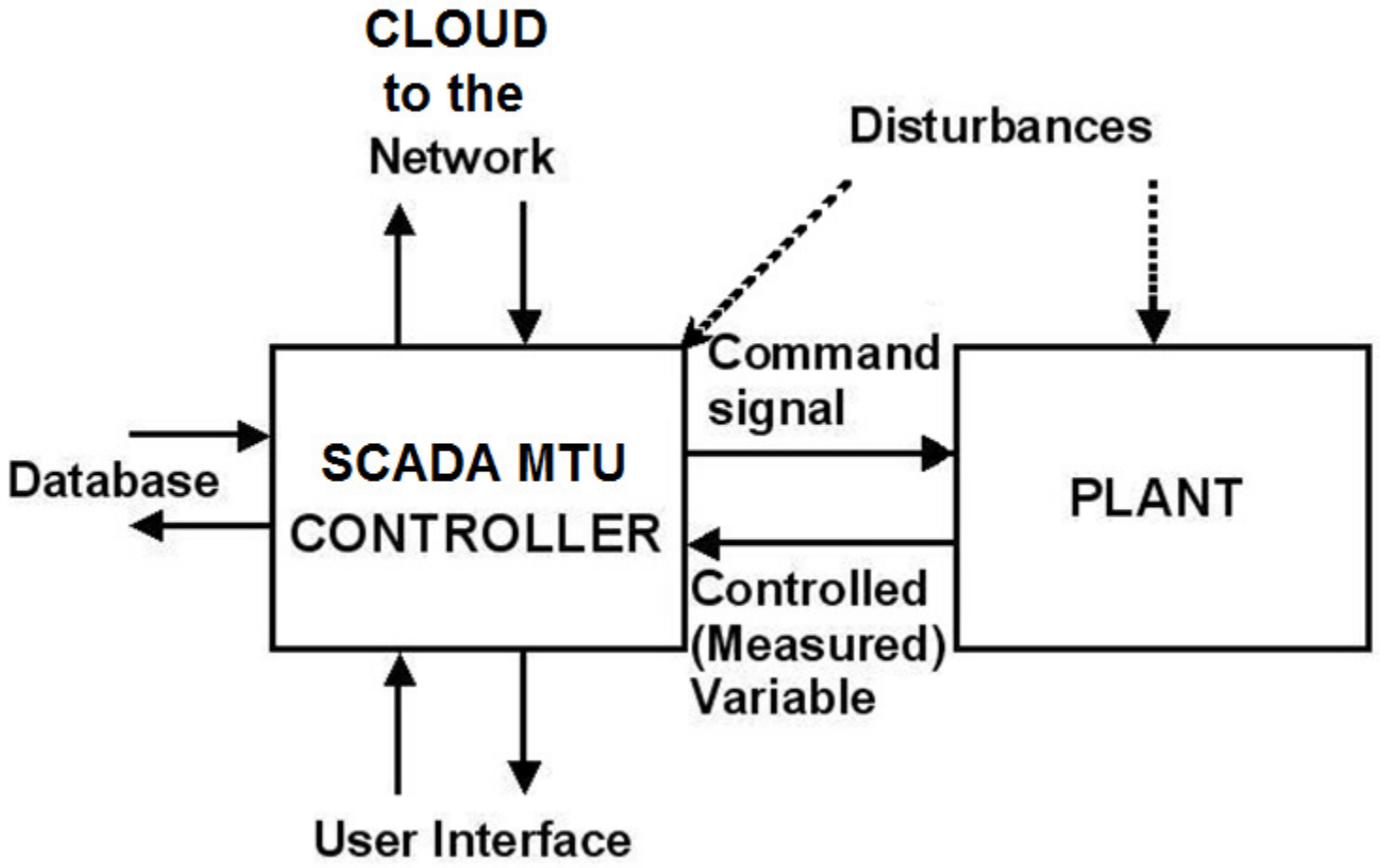

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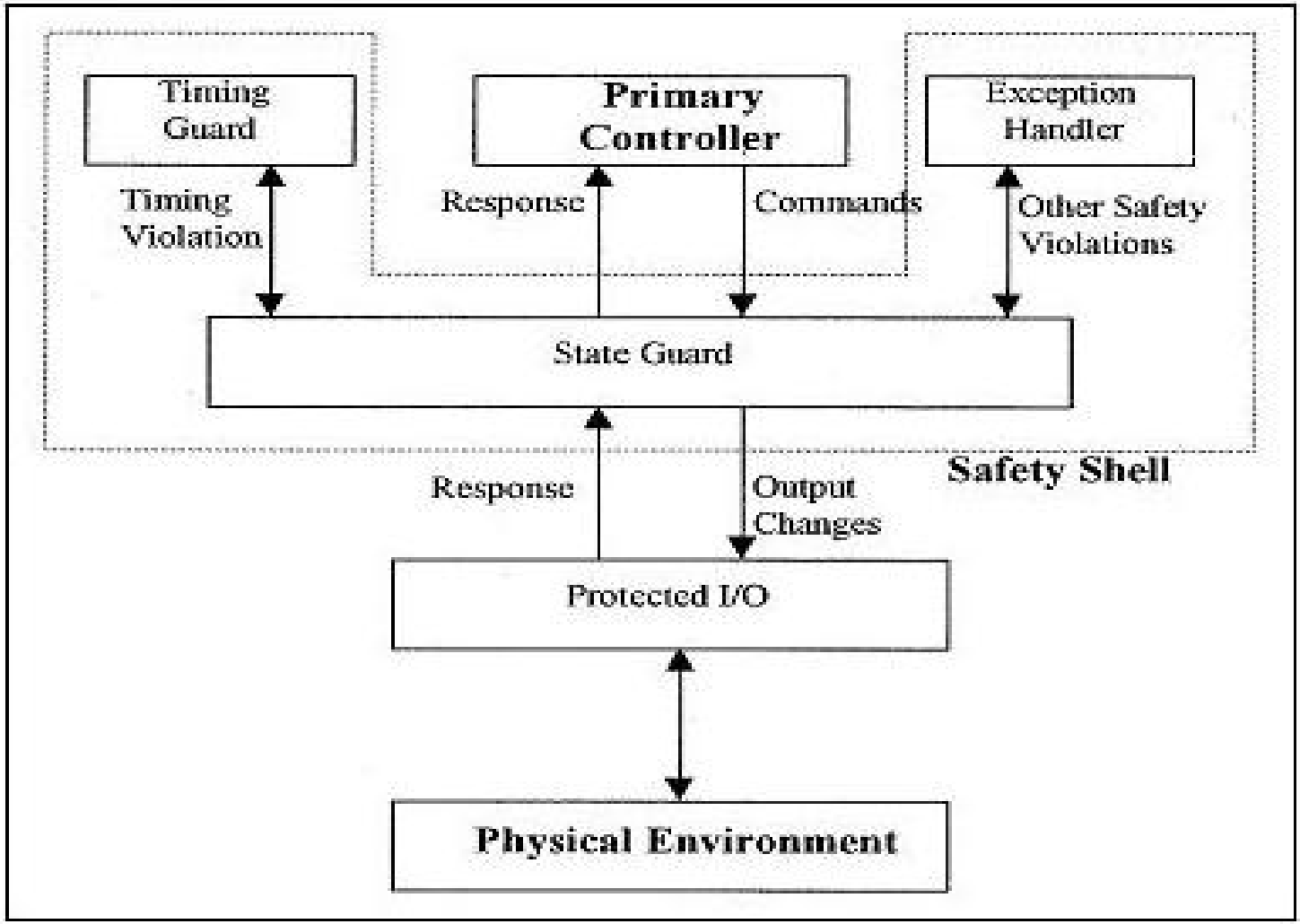
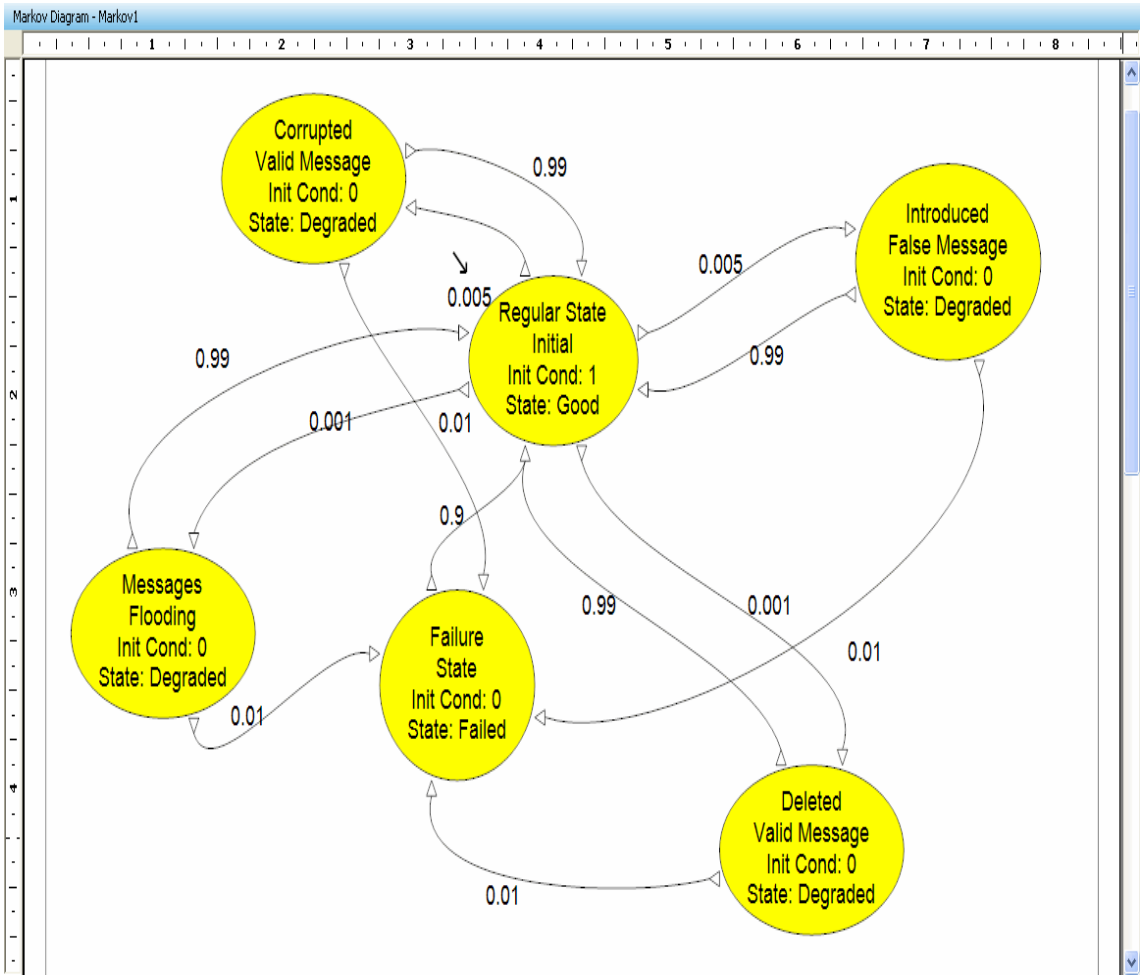


Example of Modeling Security



Source: "Availability Assessment of Embedded Systems with Security Vulnerabilities", A. Kornecki and J. Zalewski, 34th IEEE Software Engineering Workshop, Limerick, 2011

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Conclusion

There are multiple advantages of an integrated architecture

- Essential operations handle through cloud service provider
- IT and SCADA can be interlinked and integrated
- Better management of SCADA and IT systems

However …

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Transferring Safety and Security to the Cloud requires attention

- A cloud-based system should not affect the overall computing system safety – should professional management take care of data centers and associated hardware and software?
- A cloud-based system makes the overall computing system secure – should professionals take care of security issues at a central location?
- Enterprise IT and process control system divisions can focus on their core missions